INTRODUCTION

by
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The first self-sustaining nuclear chain reaction on 2 December 1942 was the result of an enormously large research effort and led to still larger efforts in the years to come. What was achieved in the years immediately following was made possible only through an unprecedented combination of talents representing many different fields of science and technology.

In fact, it was largely through the developments in the atomic energy field during the war that large-scale scientific research emerged as an important concept in national planning. National atomic energy organizations in several countries started functioning after the war and their activities in many cases led to a scientific effort of unprecedented magnitude. The atom had acquired a certain glamour, which paved the way towards an understanding and appreciation of the scientific approach on the part of governments and of society in general. The value of this new awareness cannot be overestimated, and can now be seen in countries which - though they entered the atomic field without any significant tradition of development in the basic sciences - have overcome the initial difficulties through a conscientious and vigorous effort and been able in less than a decade not only to establish the necessary base in physics and chemistry, but also to start some applied technological work in the atomic field.

This trend has probably been of the greatest importance in some of the developing countries, which have been able to take a real leap forward through the initiative of a few able people, supported by understanding governments.

The enthusiastic support that atomic energy activities have received from national governments has made some people look upon these activities with a certain amount of envy. It has been said that quicker and larger returns could be expected if other branches of science and technology were supported in the same generous way. This may be true, but it is a fact of paramount importance that in atomic energy governments and society in general have had an opportunity to see what can be done through a co-ordinated research and development effort.

Immediately after the war, when the basic knowledge of atomic energy spread all over the world, it was thought that this new source of energy could be put to widespread practical use within a very short time. As the basic phenomena were known, the basic technology was also thought to be understood and it seemed that all that was needed was a certain development of technique. There was also a sense of urgency arising from a picture of scarcity drawn by - as we now know, too pessimistic - estimates of conventional fuel reserves. Now, twenty years after the first reactor was put into operation, we have learnt that development in this field must meet the same obstacles and follow the same sequence as in the case of every other major technological advance - for example, in the aircraft industry - involving only small steps at a time. It is by these small steps forward that nuclear power will ultimately be established in the economic framework of society. Appraisals and reappraisals have succeeded each other very frequently, but the gradual trend has been towards a common view that the new source of energy will, for a considerable period of time, just complement the conventional sources and that the introduction of nuclear power will not be a sudden event, but instead a gradual process.

In the meantime, the benefits accruing from an important by-product - the radioisotopes - and their use in an amazing variety of applications should be especially mentioned. To a degree unknown before the war, they are now indispensable tools in different branches of research and becoming increasingly useful in industrial operations.

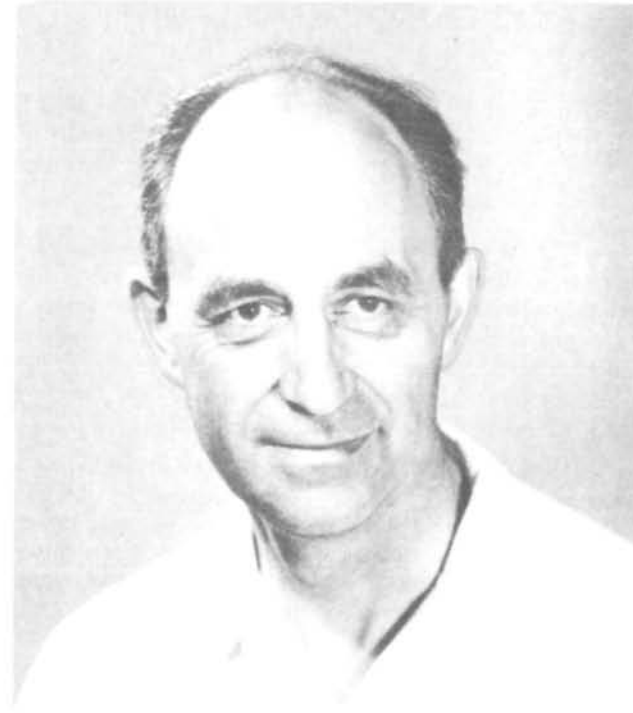
All countries, advanced or less advanced, have profited from the dissemination of knowledge which has occurred since most results in the atomic energy field became declassified after the war. It is perhaps correct to say that never before has information about a new branch of science and technology been so widely and quickly distributed; the international conferences in Geneva in 1955 and 1958 have been the two most important milestones in this respect.

The belief that atomic energy could revolutionize the economy of the world fairly rapidly might have been one of the reasons why a special reference was made in the Statute of the International Atomic Energy Agency to the needs of the developing countries. At the same time, it has been pointed out that such countries must first organize the necessary scientific education and training before entering so specialized a field as atomic energy. It can, however, be argued that in embarking on atomic development directly without passing through all the preliminary stages a country is confronted with a challenge which may be very stimulating and may itself encourage the rapid development of scientific education and training at different levels. The construction of a small research

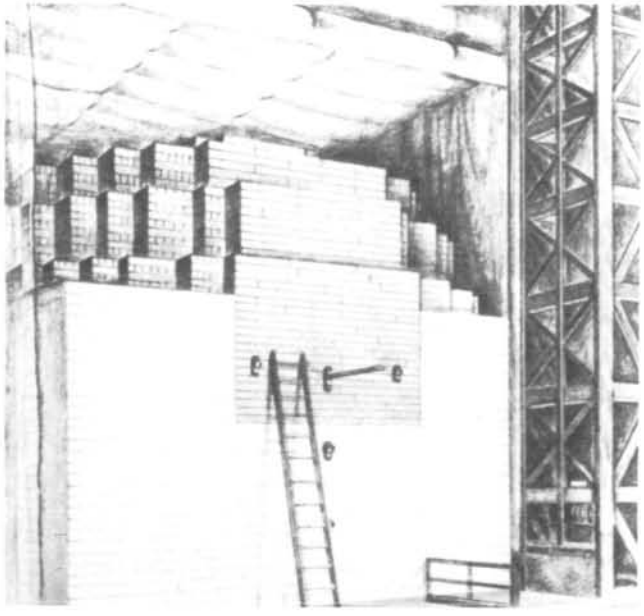
reactor or the establishment of a research programme using isotopes may thus very well act as a spurt to scientific and technical activity in other fields also, and thereby help the less developed countries in participating in the scientific and technological race of the modern world. Perhaps certain other scientific enterprises are now stealing some of the glamour of the atom, but the important fact remains that it is the remarkable advance of atomic energy within a very short time that has demonstrated the possibility of rapid scientific and technological growth in the developing countries through a concentrated and coordinated effort.

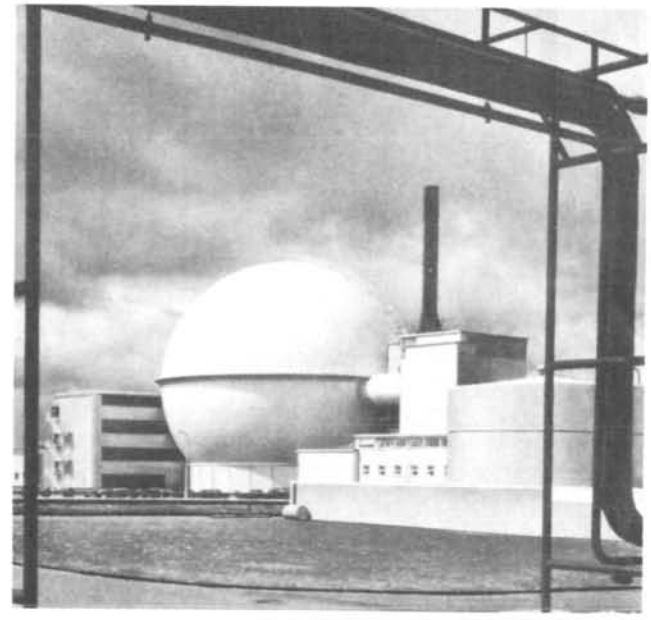
I have been led to make these general observations on the impact of atomic energy on the progress of science and technology in the world from a consideration of some of the far-reaching consequences flowing from the first controlled release of nuclear energy twenty years ago. From the purely scientific point of view, of course, one could observe many other important and complex consequences, and doubtless some of them will be reviewed on the occasion of the 20th anniversary of the world's first nuclear reactor. A most interesting and important question relates to the influence which state support and state control may have on the traditional freedom in science.

What atomic energy has meant and is likely to mean to the world has often been discussed in detail.



Enrico Fermi (Photo Los Alamos)





These two pictures give an idea of the advance in reactor technology during the last twenty years. On left is a sketch of the world's first self-sustaining nuclear reactor, operated at Chicago on 2 December 1942; on right is a photograph, taken in June 1962, of the fast breeder reactor at Dounreay, United Kingdom (The first is a U.S. Army photo; the second is from UKAEA)

In planning this anniversary issue of the IAEA Bulletin we wanted to commemorate the day on which the atomic age, in much more than a merely rhetorical sense, may be said to have begun. At the same time, it must be realized that what happened on that day was not an isolated - nor even an unexpected - event; it was a step in a long sequence. In commemorating that crucial step, it is worth while to see it against what had gone before and what has followed since. I hope this anniversary issue will help in a wider understanding of this sequence of development.

A number of eminent scientists who were intimately connected with the early phases of the development of atomic energy have contributed to this anniversary issue. Some of them have reported on the work that led to, or was connected with, the Chicago pile, while some others have described developments in this field in other countries.

In reading the articles I was struck by the fact that several of the scientists who participated actively in atomic energy work twenty years ago have been and are closely associated with the work of the International Atomic Energy Agency, and it may not be unreasonable to hope that with the advice and guidance of these distinguished scientists and with the scientific and technical competence which is now directly at its disposal, the Agency should be able to fulfil the main tasks enjoined on it by its Statute. The development of atomic energy has furnished a remarkable example of international co-operation. This is all the more remarkable since originally this branch of knowledge was a most carefully guarded secret and was only later to become an area where the general endeavour to release all available information became almost competitive.

We owe much to the many talented scientists and technicians who through their work made the present development of atomic energy possible. The International Atomic Energy Agency could pay no better tribute to these men and women than to strive towards efficient international co-operation in the peaceful utilization of nuclear energy, without which mankind cannot expect to profit fully from the vast possibilities that lie ahead.

To all those who have made possible the publication of this special number of the IAEA Bulletin, I wish to express my most sincere thanks.